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(54) Title: LIQUID-CRISTAL DISPLAY AND THE METHOD OF ITS FABRICATION		
(57) Abstract <p>The present invention is aimed to make displays with wide viewing angle possessing higher brightness in transmission mode and to develop more simple method for making such displays. This target is achieved by making in display with multiple pixels deflecting elements (5, 6) of dielectric material and depositing them over the electric conductive coating at least on one of the substrates (1, 2) the space between which is occupied by liquid crystal. Dielectric deflecting elements (5, 6) may be displaced along the perimeter of the pixel as well as across its area. After applying electric voltage to the electrodes (3) at the opposite substrates (1, 2) at the interface LC-dielectric deflecting element distortions of the electric field arise with the component of electric field parallel to the substrates.</p>		

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LIQUID-CRISTAL DISPLAY AND THE METHOD OF ITS FABRICATION

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Field of the Invention

Invention is related to the field of electronics and can be used for making information displays, in particular, liquid crystal (LC) indicators, screens, panels etc.

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Prior Art

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The drawback of the majority of liquid crystal displays is a strong dependence of their transmission on the angle of light incidence [S.T.Wu, C.S.Wu, SID Digest 27, 763 (1996)-1] and, as a result, decrease of contrast and even inversion of transmission levels at some observation angles. For improving these characteristics of displays in many cases a set of retardation plates is used [N.Yamagishi, H.Watanabe, K.Yokoyama, 'Japan Display 89', 316 (1989)-2], which increases the cost of the device and does not resolve the problem of color inversion.

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The most promising from this point of view are multi-domain LC displays, in which a single pixel contains areas with various orientations of the liquid crystal in the plane of substrates [M.Schadt, Proc.SID'97, 24.1 (1997)-3].

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There is an information display [K.-H.Kim, S.-B.Park, J.-U.Shim, J.-H.Souk, J.Chen, SID 98 DIGEST, 1085 (1998)-4], which consists of two plane and parallel substrates with electrodes deposited at least on one of them, the said substrates are overlaid with the electrodes facing each other. The space between the substrates is filled with a homeotropically aligned liquid crystal mixture possessing positive anisotropy. From the outside the substrates are surrounded by two crossed polaroids. In the off state this display does not transmit the light. After electric voltage of the opposite polarity is applied to the neighboring electrodes at one of the substrates, a parabolic electric field is created between the said electrodes, which reorients the liquid crystal parallel to it. In this way it is possible to orient LC molecules between the

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electrodes in two different directions (the so-called two-domain structure) and as the result, the viewing angle of such display is improved considerably. To maximize the brightness polaroids are oriented at 45° to the electrodes. Nevertheless, low brightness is the drawback of this display, as well as of other displays based on director re-switching in the plane of the substrates [M.Ohta et al, Asia Display'95, 707 (1995)-5]. Another drawback is that it is impossible to have more than two domains in a pixel.

There is display [S.-C. A.Lien, R.A.John, Patent USA, US5,309,264-6], [S.-C. A.Lien, R.A.John, et al, SID 98 DIGEST, 1123 (1998)-7], in which two principles are used to have domain structure: fringe field, which arises at the edge of the electrode after applying electric field, and ridge field at the opposite slopes of the protrusions formed lithographically at the opposite substrates with color filters. Protrusions act as elements which incline LC director from the normal to the substrate. The space between the substrates is filled with homeotropically aligned liquid crystal possessing negative dielectric anisotropy. Liquid crystal molecules are aligned perpendicularly to the substrates surface and in the off state this display does not transmit the light (crossed polaroids) and only on the slopes of protrusions the molecules deviate from the normal to the angle which equals the angle between the slope of the protrusion and the substrate. At the slopes the molecules are pre-tilted in different directions, but pre-tilt is not high and therefore it does not perturb optical parameters of display in the off state. Within the pixel protrusions are oriented so that the pre-tilt direction coincides with the direction of the fringe field which arises at the long edge of the pixel (the pixel has elongated rectangular shape). In such display co-action of the fringe electric field and protrusions result in reorienting LC molecules within the pixel in different directions relative to the long axes of the protrusions. The drawback of such device is that although it is possible to have four domains within a pixel (this number of domains is optimal for equalizing optical characteristics in different directions), but in a real display these domains have different area and it is difficult to equalize optical characteristics completely. Besides this, the fringe field which arises around the pixel after applying electric voltage is distorted by connecting buses and this results in non-uniform switching of various domains within a pixel.

The closest to the proposed devices and method is technical reference [A.Takeda et al, SID 98 DIGEST, 1077 (1998)-8]. This display consists of two substrates with the pattern of electrodes

deposited on them, on the said electrodes protrusions are deposited photolithographically with the slopes in different directions. These protrusions like similar elements in [7] tilt the LC director from the normal of the substrate. The space between the substrates is filled with homeotropically aligned liquid crystal possessing negative dielectric anisotropy. In the off state the LC molecules are orthogonal to the substrates except those in the areas where the protrusions are displaced. At the slopes of the protrusions the molecules are pre-tilted to the angle, which equals the angle between the slope and the substrate. This pre-tilt is not high and does not perturb optical characteristics of the display in the off state and in crossed polaroids display does not transmit the light. When the voltage is applied to the electrodes at the opposite substrates this pre-tilt is sufficient to initiate molecular reorientation in different directions within the pixel area. This leads to appearing domains and makes viewing angle more uniform. The drawback of this display is low brightness (30% of conventional single-domain display) because of two factors: protrusions occupy more than 30% of the display area and to realize four domains very specific pattern of the protrusions is required, which leads to additional losses of light. Besides this to make this display two additional photolithographies are required.

Summary of the Invention

Present invention is aimed to make displays with wide viewing angle possessing higher brightness in transmission mode and to develop more simple method for making such displays.

This target is achieved by making in display with multiple pixels deflecting elements of dielectric material and depositing them over the electric conductive coating at least on one of the substrates the space between which is occupied by liquid crystal. Dielectric elements can have profile as from the liquid crystal side, so from the side of the substrate. They can be deposited on both, as well as only on one substrate. Dielectric deflecting elements may be displaced along the perimeter of the pixel as well as across its area. After applying electric voltage to the electrodes at the opposite substrates at the interface LC-dielectric deflecting element distortions of the electric field appear with the component of electric field parallel to the substrates. Direction of this in-plane component is determined by the configuration of the dielectric deflecting elements. The value of this component is sufficient to reorient liquid crystal in different directions and hence to generate different domains within the pixel area and to make optical properties of display independent of the viewing angle. Unlike in the known display [8],

dielectric elements take not more than 5-10% of the pixel area and proposed display has higher brightness. At the same time configuration of the dielectric elements is capable of obtaining two- as well as four domain displays for any real pixel shape.

5 Brief Description of the Drawings

Figs.1-2 show the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method with various displacement of the dielectric deflecting elements.

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Fig.3 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method, in the said display the dielectric deflecting elements are displaced at the color filters substrate and play the role of the black mask.

15 Fig.4 shows the top view of the displays fabricated according to the proposed method with various displacement of the dielectric deflecting elements.

20 Figs.5-8 show the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method with various displacement of the dielectric deflecting elements in the cases when these elements have profiled thickness at the side of the substrate.

Fig.9 shows the cross-section (a) and the top view (b) of the proposed two-domain display, fabricated according to the proposed method with planar alignment of the liquid crystal.

25 Detailed Description of the Preferable Embodiments

The proposed displays are fabricated as following.

30 On one or both substrates with aligning layer deposited on them dielectric deflecting elements are patterned on the top of the last electric conductive layer. Resistivity of the deflecting elements should not be substantially lower than that of the liquid crystal material, the last is usually higher than 10^8 Ohm/cm.

Deflecting elements are usually formed photolithographically. Most often they have shape of solid or dashed lines with the intervals between the dashes 5-30 μm , the line-width 2-3 μm and larger and the height (or depth) from 0.1 μm up to the LC thickness. The cross section of the deflecting dielectric elements may have the shape of any geometric figure, such as triangle, turned with one side to the substrate, trapezium, rectangle, semicircle e.t.c. Deflecting dielectric elements are patterned to have the form of lines of any type surrounding the pixel. If pixel has elongated shape, it may be subdivided by deflecting elements into squares, or rectangles with the shape close to squares. Deflecting elements may be displaced in the gap between the electrodes and cover part of the electrode with the width comparable to the height of the element in order to avoid the influence of the fringe field on the LC orientation. The area between the deflecting elements may be filled with supplementary coatings (variants with the deflecting dielectric elements profiled from the side of the substrate). Supplementary coatings may play the role of planarizing film, or color filters matrix, or various conductive layers. This may be the areas of the substrate, between which the wells are made, which are filled with the deflecting dielectric elements.

At the second substrate deflecting elements are also deposited to have a shape of squares, or rectangles with the shape close to squares with the same dimensions as on the first substrate, or with different dimensions, or having shape of solid, or dashed lines of various form.

In the case when matrix of color filters is formed at the second substrate, deflecting dielectric elements usually align with the black matrix, or replace them by dielectric black matrix. In the latter case one technological operation is reduced.

Deflecting dielectric elements on different substrates can be made of different materials. For example, when on the color filter substrate deflecting dielectric elements are replaced by the black matrix, on the second substrate they are made from as transparent material as possible to reduce the losses of light. The height of the deflecting dielectric elements may vary across the substrate and may be different on different substrates. The first case can be useful to make displays with variable viewing angle across the display area.

At the next stage aligning layer for homeotropic or planar alignment is deposited at the substrates.

To control the gap between the substrates in the case when deflecting elements are deposited only on one substrate conventional spacers, such as spheres, or fibers, or particles of definite dimensions made of inorganic as well as organic materials are used. In the case when deflecting elements are deposited on the electrodes on both substrates and have profile from the side
5 turned to the liquid crystal, additional spacers are not necessary because deflecting dielectric elements play the role of spacers. Simultaneously, the display becomes more rugged and the LC layer thickness can be easily varied during fabrication process.

At the next stage of fabricating display with deflecting dielectric elements deposited on one
10 substrate this substrate is overlaid with another one, containing pattern of electrodes, aligning layer and conventional spacers with the said electrodes faced to each other on both substrates and is sealed along the perimeter.

In the case the display has deflecting dielectric elements on both substrates with the profile
15 from the liquid crystal side to obtain equally good viewing characteristics for all observation angles these deflecting elements are aligned so that the crossings of the lines on one substrate be as close as possible to the centers of the squares formed by deflecting dielectric elements on the second substrate. After this display is sealed.

20 If at least on one of the substrates deflecting dielectric elements are profiles from the side of the substrate, then the substrates are aligned similarly to the previous case, but conventional spacers are used to control the gap between the substrates.

As a rule, liquid crystal domains are formed of equal size to make viewing characteristics
25 independent of angle. Nevertheless, they can have different size if display should have specific viewing characteristics.

The space between the substrates is filled with liquid crystal.

30 This liquid crystal can possess either positive or negative dielectric anisotropy. Consequently, the said liquid crystal may have either planar or homeotropic alignment. Planar aligning material is rubbed. The angle between the rubbing direction and the deflecting dielectric elements may

be taken in the range $0^\circ - 180^\circ$. Both non-chiral and chiral liquid crystal materials are appropriate. In the case it is chiral and has planar alignment it may be twisted to the angle from 0° to 360° . If it has homeotropic alignment, its twist angle should be chosen so that $d/p < 0.5$ (here d - LC layer thickness, p - its spontaneous helix pitch).

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In the proposed displays liquid crystal doped with a dichroic dye can be used and then such display may operate without polaroids and information is displayed due to light absorption by the dye molecules. The dichroic ratio of the dye can be larger or smaller than 1 and liquid crystal may be chiral or non-chiral.

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Proposed displays can operate in reflective mode. In such a case one of the substrates and the electrode deposited on it are made non-transparent (reflective). The image is obtained with one polaroid.

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Fig.1 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On two plane glass substrates 1 and 2 0.5-2 mm thick and with linear dimensions on the range of 1 cm to several decimeters transparent electrodes from conductive coating 3 having thickness 70-150 nm and surface resistivity 10-2000 Ω/\square are deposited in vacuum from the oxide of the indium-tin alloy. The desirable electrode pattern is made photolithographically. On one substrate deflecting dielectric elements 5 are formed from photoresistive dielectric material, for example AR P-310, which have the shape of crossing lines with the pitch 100 μm , width 5-7 μm and height 2.5-3 μm . Both substrates 1, 2 are covered with homeotropic aligning layer 4, for example AL-655 (JSR), 20-100 nm thick. Conventional spacers, like plastic spheres 3-6 μm in diameter, are deposited on one of the substrates 1, 2.

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The substrates 1, 2 are overlaid with the aligning layers 4 faced to each other and fixed together with the sealing material having epoxy base, for example UHU plus endfest 300. The space between the substrates 1, 2 is filled with liquid crystal possessing negative dielectric anisotropy, such as MLC-6608. So made display transmits 45-50% of light in the on state in crossed polaroids (for 100% we take the light transmitted by display in the off state between the parallel

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polaroids).

Fig.2 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On two plane glass substrates 1 and 2 on the top of the conductive layer 3 deflecting dielectric elements (5), (6) are deposited in the form of crossing lines with the width 5-6 μm , their height is 2.0-2.5 μm and the pitch - 100 μm . The substrates 1, 2 are aligned so, that line crossings on one substrate are close to the centers of the squares formed by the lines on the second substrate. The crossings of the lines on different substrates are used as spacers. Single pixel abcd is surrounded by thicker vertical lines and two horizontal lines placed at the bottom substrate 1. So made display transmits 75-80% of light in the on state in crossed polaroids.

Fig.3 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method, in which deflecting elements 5 at the color filters substrate are made of non-transparent dielectric material and have the form of lines 5-15 μm thick with the height 2-2.5 μm above the color filters surface. Simultaneously these deflecting elements play the role of the black matrix. Pixel abcd is surrounded by peripheral vertical lines and two horizontal lines placed at the bottom substrate 1. In other aspects the display is made similarly to that one described in fig.2. This display has brightness 60-80% in the on state.

Fig.4 shows the top view of the proposed displays fabricated according to the proposed method with various displacements of the deflecting dielectric elements 1 and 2 on the bottom and the top substrates respectively. Single pixel is displayed. In other aspects the display is made similarly to that one described in fig.2. This display has brightness 75-80% in the on state.

Fig.5 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On the bottom 1 and top 2 substrates containing the electrodes pattern 3 deflecting dielectric elements 5 and 6 are deposited. On the bottom substrate 1 the area between the dielectric deflecting elements is filled with a supplementary layer 7 possessing dielectric constant different from that of the deflecting elements (dielectric deflecting elements are profiled from the side of the substrate). On the top of all patterns on both substrates 1, 2 homeotropically aligning layer 4 is deposited. Conventional spacers, like plastic spheres 3-6 μm in diameter, are used. Pixel abcd is surrounded by thicker vertical lines

and two horizontal lines placed at the bottom substrate 1. In other aspects the display is made similarly to that one described in fig. 1. This display has brightness 75-80% in the on state.

Fig.6 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On the bottom 1 and top 2 substrates containing the electrodes pattern 3 deflecting dielectric elements 5 and 6 are deposited. On the bottom substrate 1 the area between the dielectric deflecting elements is filled with a supplementary layer 7 possessing dielectric constant different from that of the deflecting elements (dielectric deflecting elements are profiled from the side of the substrate). On the top of the supplementary layer 7 conductive coating 3 is deposited. On the top of all patterns on both substrates 1, 2 homeotropically aligning layer 4 is deposited. Conventional spacers are used. Pixel abcd is surrounded by thicker vertical lines and two horizontal lines placed at the bottom substrate 1. In other aspects the display is made similarly to that one described in fig.1. This display has brightness 75-80% in the on state.

Fig.7 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On the bottom 1 and top 2 substrates containing the electrodes pattern deflecting dielectric elements 5 and 6 are deposited. On the bottom substrate 1 the area between the dielectric deflecting elements 5 is filled with a supplementary layer 7 possessing dielectric constant different from that of the deflecting elements (dielectric deflecting elements are profiled from the side of the substrate). On the top of the supplementary layer 7 conductive coating 3 is deposited. On the top of conductive coating 3 the film made of material of the deflecting dielectric element is displaced and covered with the aligning film 4. Conventional spacers are used. Pixel abcd is surrounded by thicker vertical lines and two horizontal lines placed at the bottom substrate 1. In other aspects the display is made similarly to that one described in fig.1. This display has brightness 75-80% in the on state.

Fig.8 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On the bottom 1 and top 2 substrates containing the electrodes pattern deflecting dielectric elements 5 and 6 are deposited. On the bottom substrate 1 the area between the dielectric deflecting elements 5 is filled with a supplementary layer 7 which is made of the same material as the substrate (in a real process the grooves are made in the substrate in advance and after depositing electric conductive coating the grooves are filled

with the dielectric deflecting elements 5). On the top of the supplementary layer 7 conductive coating 3 is deposited. On the top of conductive coating 3 the aligning film 4 is displaced. Conventional spacers are used. Pixel abcd is surrounded by peripheral vertical lines and two horizontal lines placed at the bottom substrate 1. In other aspects the display is made similarly to that one described in fig. 1. This display has brightness 75-80% in the on state.

Fig.9 shows the cross-section (a) and the top view (b) of the proposed display, fabricated according to the proposed method. On two plane glass substrates 1, 2 on the top of the conductive layer 3 deflecting dielectric elements 5, 6 are deposited. On one substrate, let us tell substrate 1, deflecting elements 5 have the form of crossing dielectric lines and on another substrate, for example 2, they look like dielectric lines. Lines on the both substrates 1, 2 have the width 5-6 μm , their height is 2.0-2.5 μm and the pitch - 100 μm . The substrates 1, 2 are aligned so, that the lines on substrate 2 cross the sides of the rectangles formed by the lines on the substrate 1 close to their centers. The crossings of the lines on substrate 1 with the lines on the substrate 2 are used as spacers. Planar aligning layer 4, for example AL-3046 (JSR), is deposited on both substrates 1, 2. The substrates 1, 2 are rubbed parallel to each other and perpendicular to the lines on the substrate 2. The space between the substrates 1, 2 is filled with a nematic liquid crystal ZLI-3497-000 possessing positive dielectric anisotropy. Single pixel abcd is surrounded by thicker vertical lines and two horizontal lines placed at the bottom substrate 1. So made display transmits 85-90% of light in the off state in crossed polaroids.

The proposed display with homeotropic alignment of the liquid crystal possessing negative dielectric anisotropy operates as following.

In the state without electric field LC molecules are aligned orthogonal to the substrates 1, 2 in the whole area except the slopes of the deflecting dielectric elements 5, 6, in the case their profile is from the liquid crystal side. In difference to [7,8], in the proposed display the slopes of the deflecting elements are either very steep (the angle with the substrate normally is bigger than 30-40°), or they are absent at all, in the case they are profiled from the substrate side. So distortions of the liquid crystal alignment either have limited size, or absent at all and do not perturb optical parameters of the display. Therefore in the off state this display does not transmit light in the crossed polaroids.

After applying electric field liquid crystal reorients not uniformly across the pixel area, but according to the direction of the parallel to the substrates component of the electric field which appears at the LC - dielectric interface. This way domains with different (including opposite) orientation of the liquid crystal appear within the pixel area. Under various observation angles different domains have different transmittance and transmittance of the pixel as a whole equals some averaged value. Due to this, inversion of the transmission levels of LC display under various observation angles is suppressed, similarly to the effect observed in [7,8]. To increase the viewing angle (to increase the contrast under oblique observation angles) phase retarders [2] may be used in the proposed display.

Display with LC possessing positive dielectric anisotropy and aligned parallel to the substrates operates in a similar way. The difference is that in the off state this display transmits light in crossed polaroids. After applying electric field LC reorients in different directions depending on the direction of the in-plane with the substrates component of the distorted electric field, which is created at the LC-dielectric interface. As the result, viewing characteristics become similar for different observation angles. In the on state display becomes non-transparent.

Summarizing the analysis of the proposed display and the method for its fabrication one can tell, that using conventional technology for making LC displays, in which only one technological photolithographic stage is added for making deflecting dielectric elements, it is easy to obtain display with wide viewing angle. The number of domains, their displacements, as well as proportion of their areas can be easily varied by varying photolithographically made pattern. Besides this, in transmission mode the losses of light are in the range of 10-20% in comparison with conventional single-domain displays, which are not essential for the desk-top displays.

CLAIMS

1. Liquid crystal display with plurality of pixels comprised of two plane substrates (1),
5 (2) with electric conductive layers deposited on the faced to each other sides of the substrates
(1), (2), covered with aligning layers (4) and with liquid crystal filling the space between the
substrates (1), (2), having deflecting elements (5), (6) and, if required, black matrix,
characterized in that
at least on one substrate deflecting elements (5), (6) are dielectric and are displaced over
10 electric conductive layers along the perimeter of each pixel.
2. Display according to claim 1, characterized in that, deflecting dielectric elements
(5), (6) are made of material with the resistivity equal, or exceeding the resistivity of the liquid
crystal.
3. Display according to claims 1-2, characterized in that, deflecting dielectric elements
15 (5), (6) are additionally displaced within the area of each pixel.
4. Display according to claims 1 or 2, characterized in that, the said black matrix is
made of deflecting dielectric elements (5), (6).
5. Display according to claims 1-4, characterized in that, deflecting dielectric elements
(5), (6) have the height in the interval 0.1-1 value of the liquid crystal thickness.
- 20 6. Display according to claim 1, characterized in that, deflecting dielectric elements
(5), (6) are displaced on both substrates (1), (2) over the electric conductive layers.
7. Display according to claim 6, characterized in that, deflecting dielectric elements
(5), (6) which are displaced over the electric conductive layers are made of different materials.
8. Display according to claims 1-7, characterized in that, deflecting dielectric elements
25 (5),(6) have varying height.
9. Liquid crystal display with plurality of pixels comprised of two plane substrates (1),
(2) with electric conductive layers deposited on the faced to each other sides of the substrates
(1), (2), covered with aligning layers (4) and with liquid crystal filling the space between the
substrates (1), (2), having deflecting elements (5), (6) and, if required, black matrix,
30 characterized in that
at least on one substrate deflecting elements are dielectric and placed over the electric
conductive layer and the area between them is filled with a supplementary coating (7).

10. Display according to claim 9, characterized in that, on the top of the supplementary coating (7) additional conductive layer is deposited.

11. Display according to claims 9 or 10, characterized in that, over the said dielectric deflecting elements (5), (6) and supplementary coating (7) additional layer is formed made of
5 the material of the said deflecting dielectric elements (5), (6).

12. Display according to claim 9, characterized in that, the said dielectric deflecting elements (5), (6) are made of material with the resistivity equal or exceeding that of the said liquid crystal.

13. Display according to claims 9-12, characterized in that, deflecting dielectric
10 elements (5), (6) are additionally displaced within the area of each pixel.

14. Display according to claims 9 or 13, characterized in that, the said black matrix is made of deflecting dielectric elements (5), (6).

15. Display according to claims 9-14, characterized in that, deflecting dielectric elements (5), (6) have the height exceeding 0.1 of the liquid crystal thickness.

16. Display according to claim 9, characterized in that, deflecting dielectric elements
15 (5), (6) are displaced on both substrates (1), (2) over the electric conductive layers.

17. Display according to claim 16, characterized in that, deflecting dielectric elements (5), (6) which are displaced over the electric conductive layers are made of different materials.

18. Display according to claims 9-16, characterized in that, deflecting dielectric
20 elements (5), (6) have varying height.

19. Display according to claim 9, characterized in that, the supplementary coating (7) is made of the same material as the substrate.

20. Display according to claim 19, characterized in that, on the top of the supplementary coating (7), which is made of the same material as the substrate, electric
25 conductive layer is deposited.

21. The method for making liquid crystal display with plurality of pixels comprised of depositing electric conductive and aligning layers on the faced to each other sides of two plane substrates, of subsequent filling liquid crystal in the space between the substrates, of forming deflecting elements and, if required, color filters and black matrix,

30 characterized in that

at least on one substrate deflecting elements are made dielectric and are displaced over the electric conductive layer.

22. The method according to claim 21, characterized in that, deflecting dielectric elements are made of material with the resistivity equal to or exceeding that of the liquid crystal.

23. The method according to claims 21 or 22, characterized in that, deflecting dielectric elements are formed on both substrates.

24. The method according to claim 23, characterized in that, deflecting dielectric elements are formed of different materials

25. The method according to claims 21-24, characterized in that, the area between the deflecting dielectric elements is filled with supplementary coating.

26. The method according to claim 25, characterized in that, on the top of the supplementary coating additional electric conductive layer is deposited.

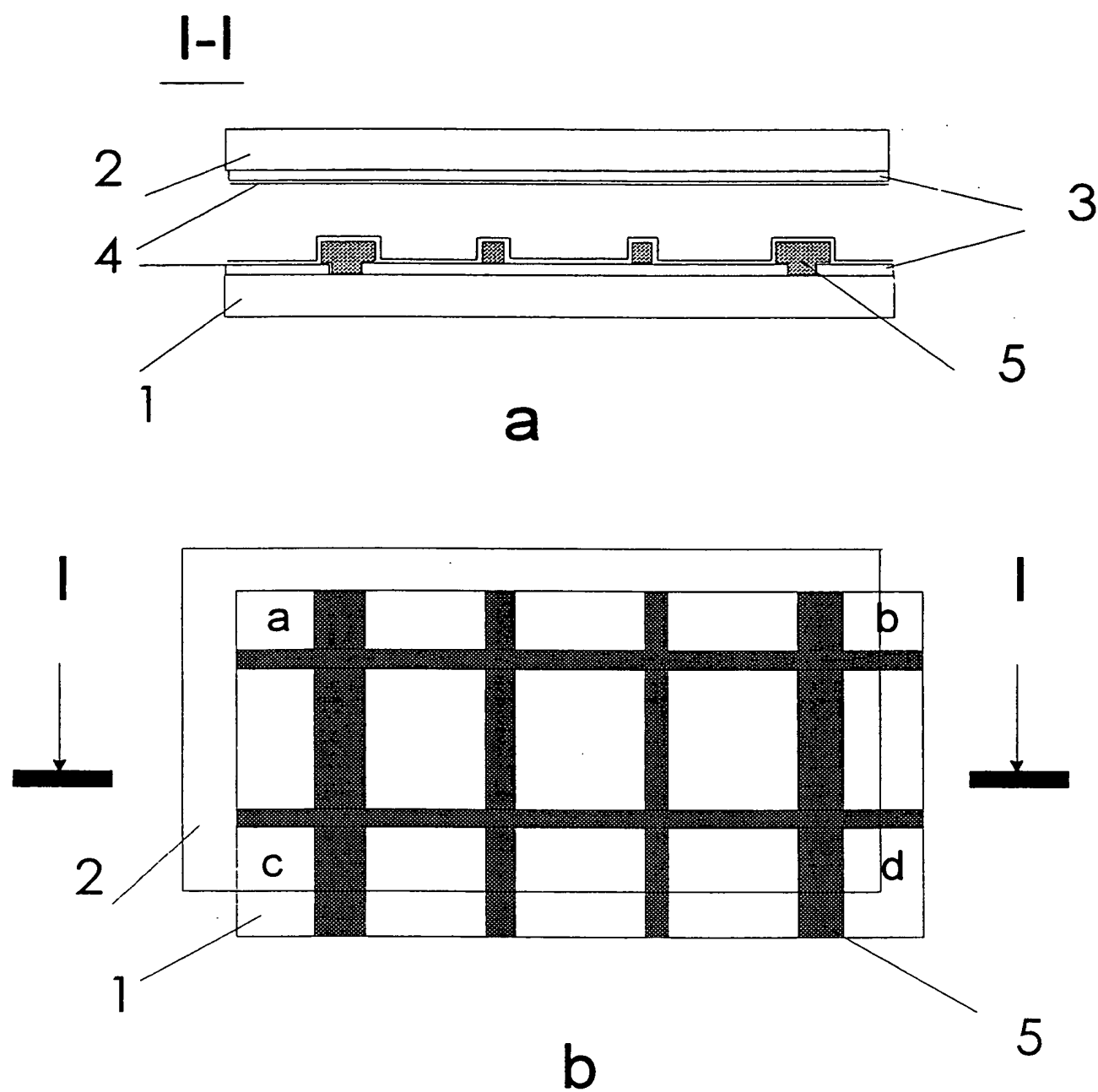
27. The method according to claims 24 or 25, characterized in that, on the top of the supplementary coating additional layer made of the material of the deflecting dielectric elements is deposited.

28. The method according to claim 21, characterized in that, the supplementary coating is made of the same material as the substrate.

29. The method according to claim 25, characterized in that, on the top of the supplementary coating electric conductive layer is deposited.

30. The method according to claims 21-23, characterized in that, the black matrix is made of the material of the deflecting dielectric elements.

31. The method according to claim 21, characterized in that, deflecting dielectric elements are formed with the height exceeding 0.1 of the liquid crystal thickness.



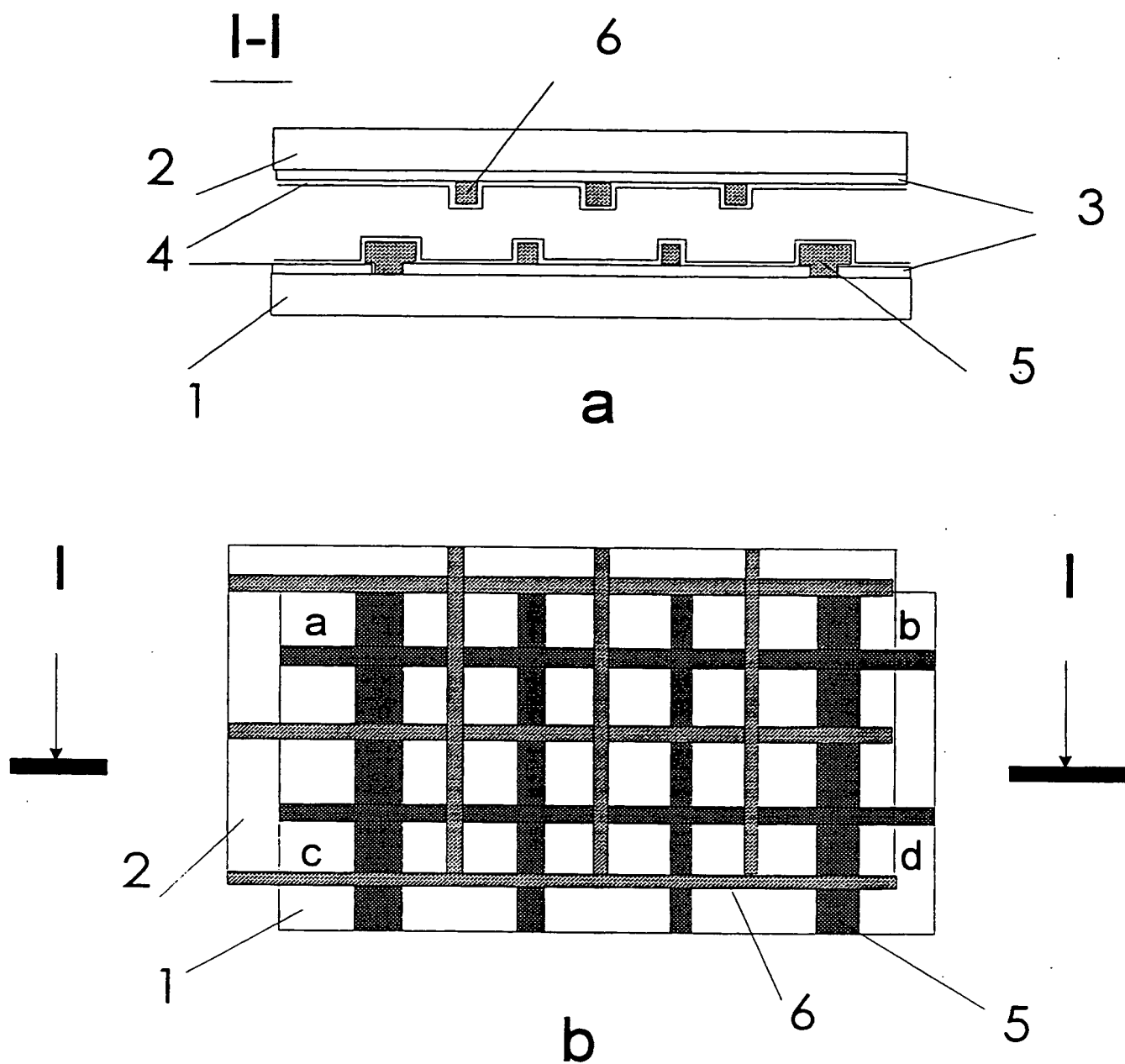


Fig.2

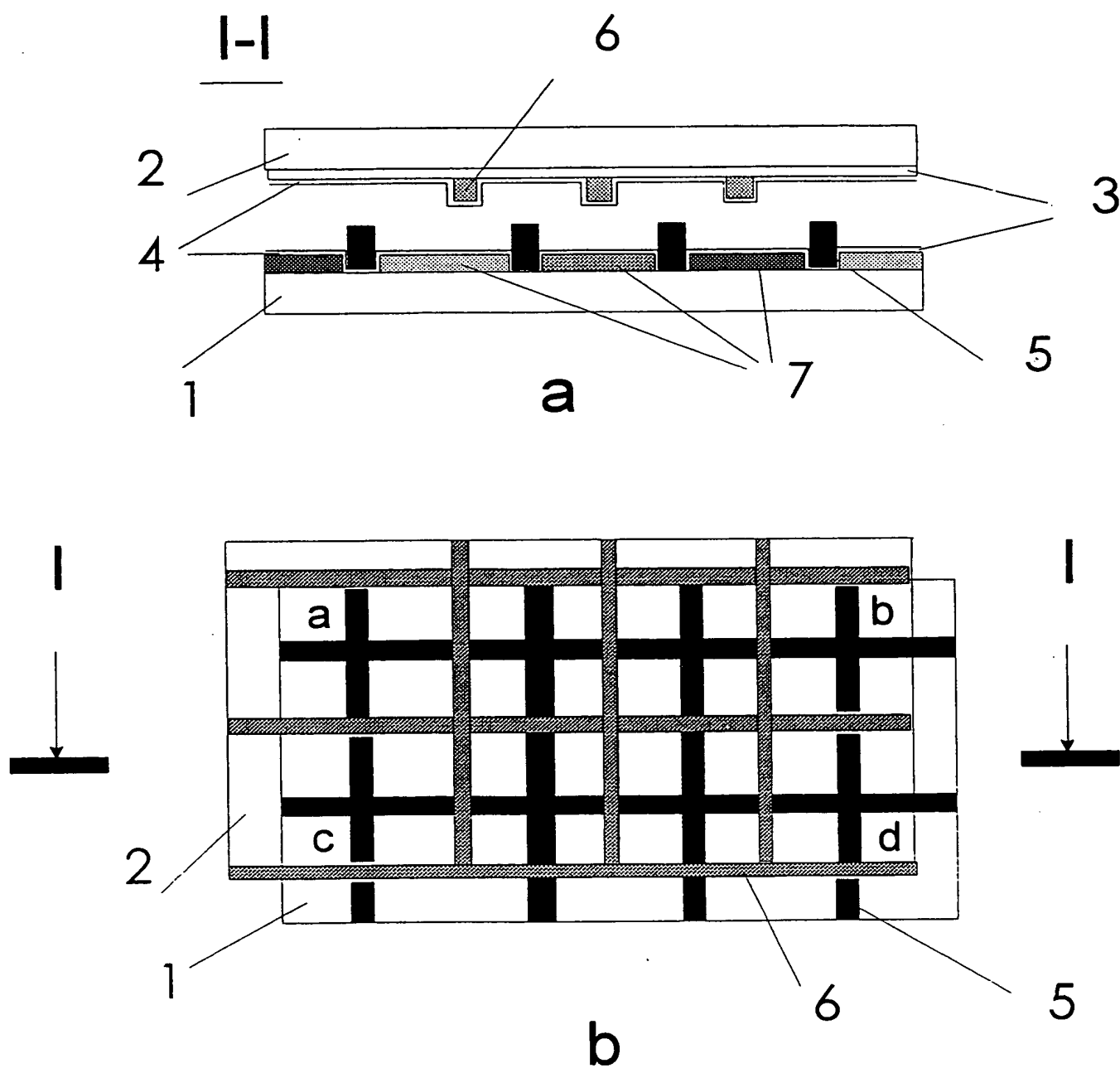
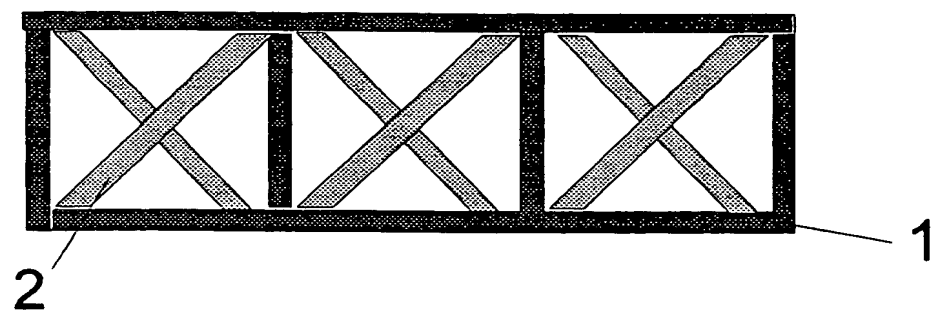
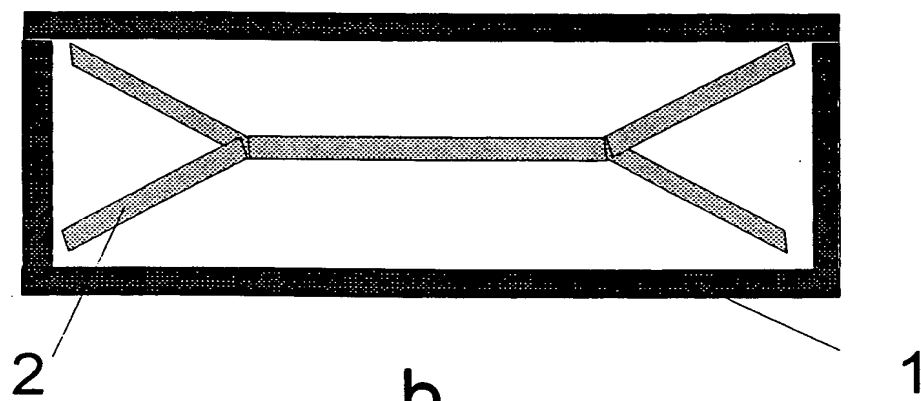


Fig. 3



a



b

Fig. 4

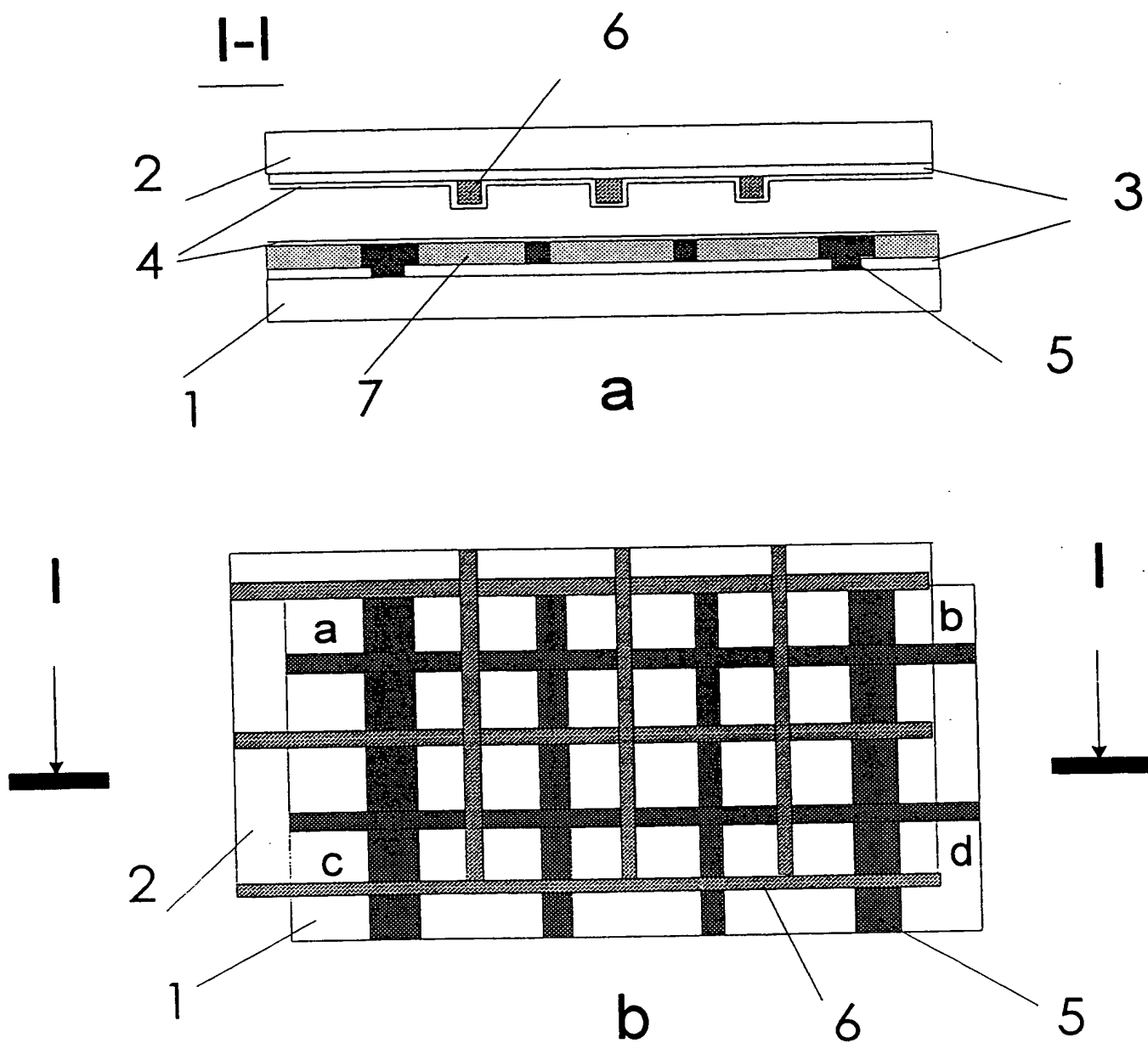


Fig. 5

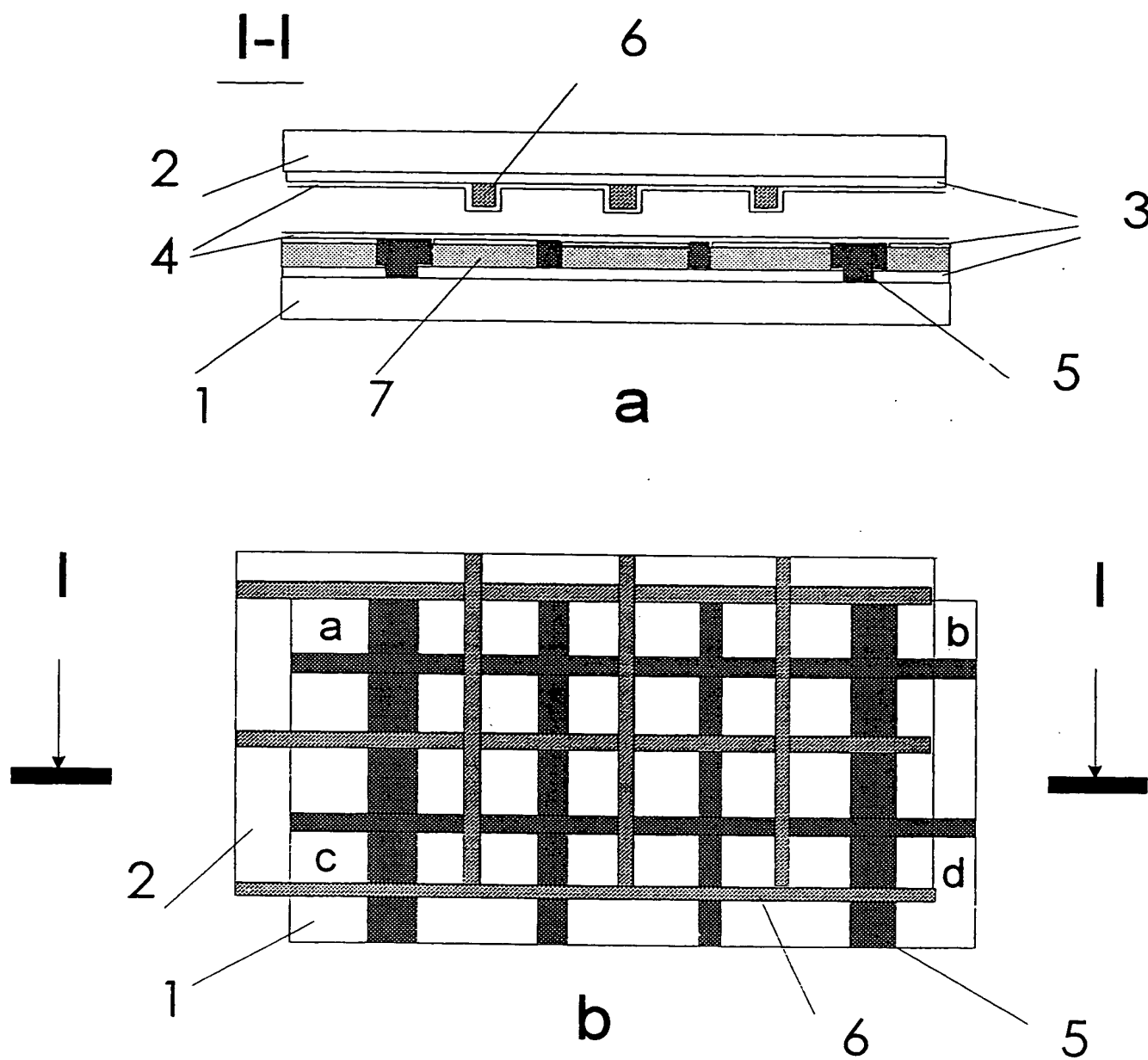


Fig. 6

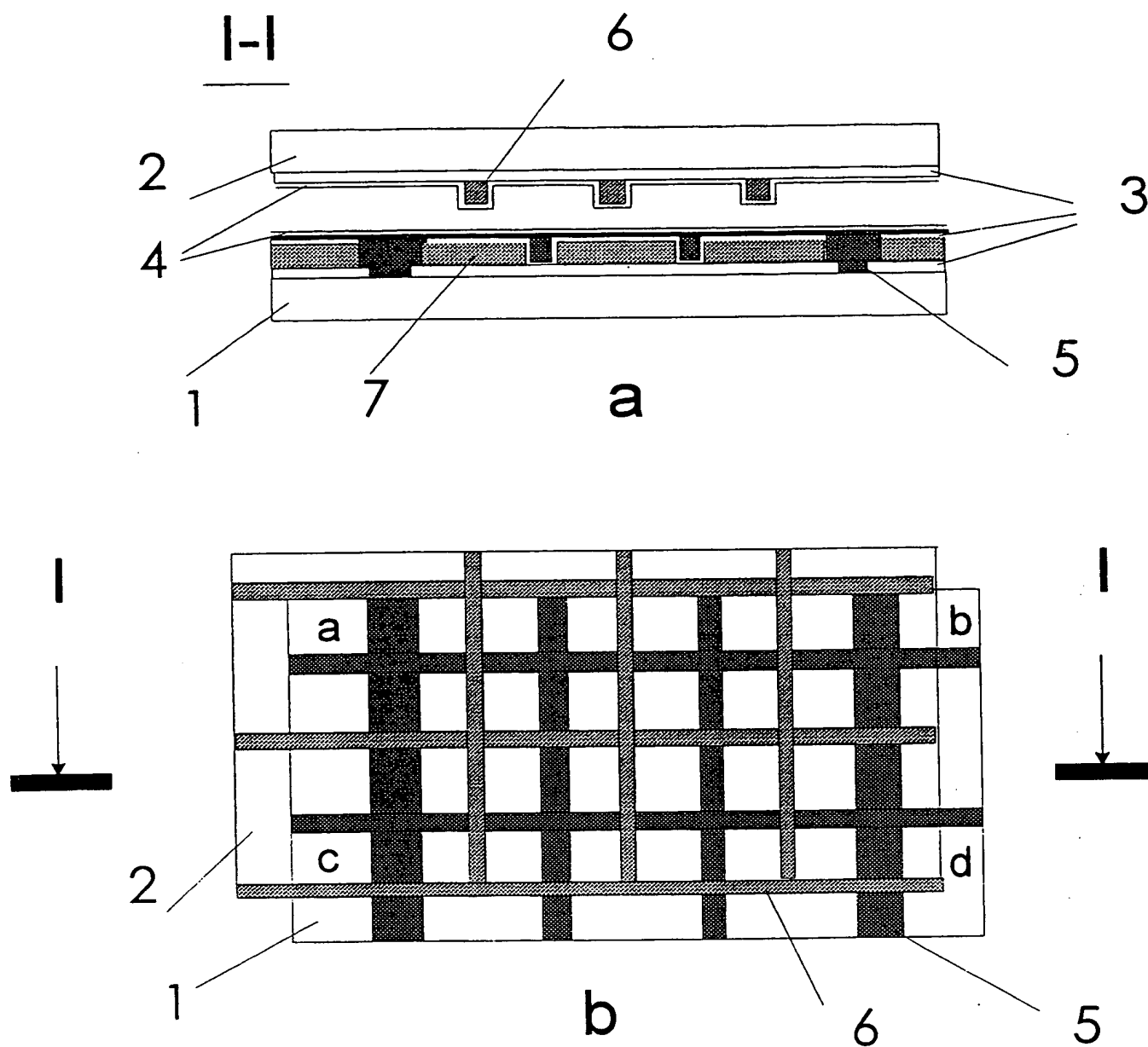


Fig. 7

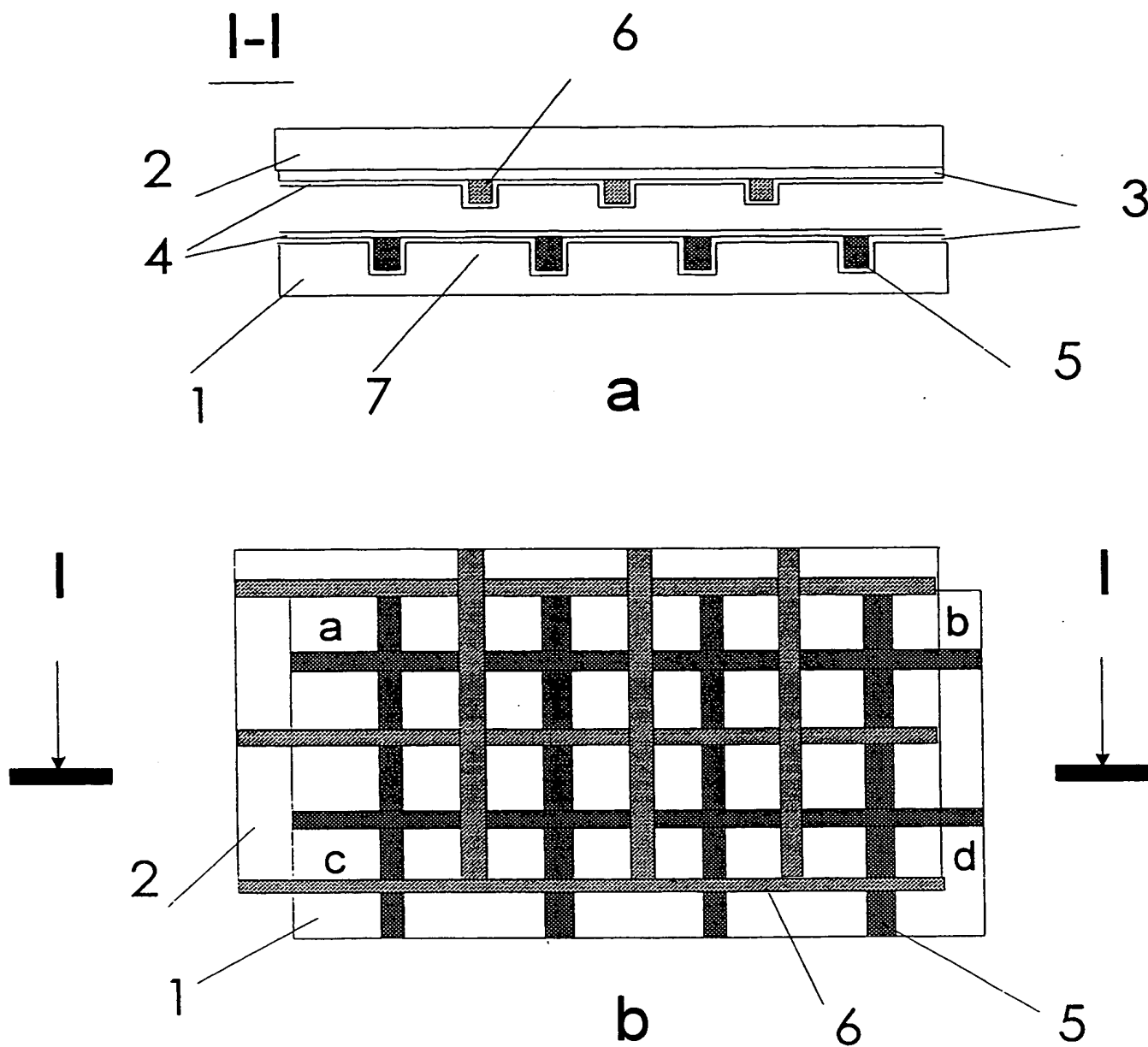


Fig. 8

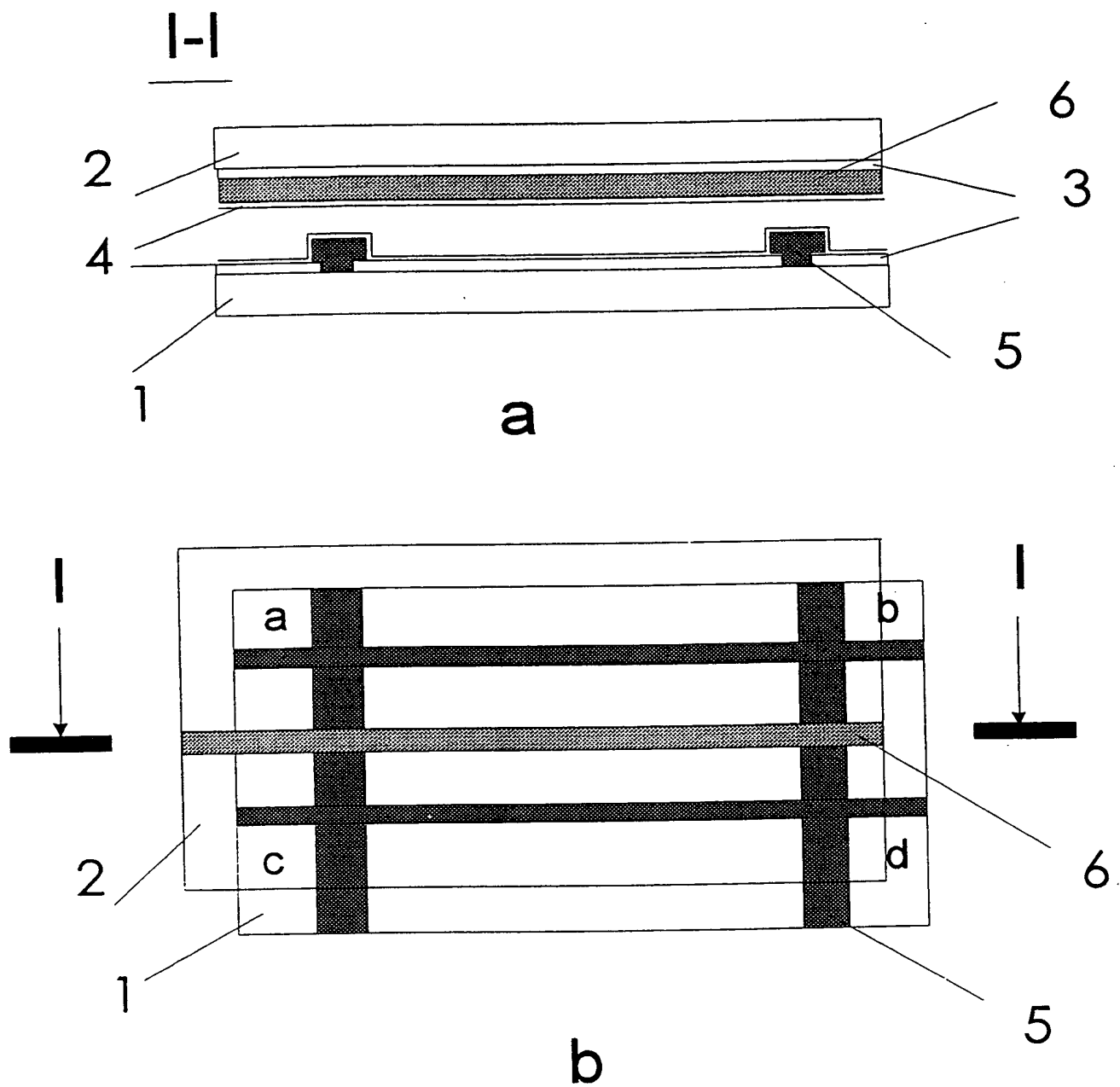


Fig. 9

INTERNATIONAL SEARCH REPORT

International Application No

PCT/BY 98/00008

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 G02F1/1337 G02F1/1333

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 G02F

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	KONVALOV: "Multi- Domain Vertically Aligned Mode" 1998 SID INTERNATIONAL SYMPOSIUM. DIGEST OF TECHNICAL PAPERS. ANAHEIM, CA, USA, 17-22 MAY 1998, vol. 29, page 44.2L XP002098703 1998, Santa Ana, CA USA, Soc. Inf. Display, USA see the whole document ---	1,21
X	EP 0 854 377 A (SHARP KK) 22 July 1998 see page 9, line 11 - page 11, line 14; figure 5A --- -/--	1-3,9, 21-23

☒

Further documents are listed in the continuation of box C.

☒

Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search

13 April 1999

Date of mailing of the international search report

22/04/1999

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Diot, P

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT		
Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	<p>LIEN: "Ridge and Fringe- Field Multi-Domain Homeotropic LCD." 1998 SID INTERNATIONAL SYMPOSIUM. DIGEST OF TECHNICAL PAPERS. ANAHEIM, CA, USA, 17-22 MAY 1998, vol. 29, pages 1123-1126, XP002098704 1998, Santa Ana, CA, USA, Soc. Inf. Display, USA cited in the application see the whole document</p> <p>---</p>	1,21
E	<p>EP 0 884 626 A (FUJITSU) 16 December 1998 see page 25, line 07 - line 45 see page 43, line 13 - page 47, line 31; figure 174</p> <p>---</p>	1-6,9,21
X	<p>US 5 644 415 A (AOKI HISASHI ET AL) 1 July 1997 see column 3, line 33 - line 66 see column 6, line 56 - column 7, line 30 see column 14, line 04 - line 53</p> <p>---</p>	1-3
A		9
A	<p>TAKEDA: "A Super- High Image Quality Multi-Domain Vertical Alignment LCD by New Rubbing-Less Technology " 1998 SID INTERNATIONAL SYMPOSIUM. DIGEST OF TECHNICAL PAPERS. ANAHEIM, CA, USA, 17-22 MAY 1991, vol. 29, pages 1070-1080, XP000791252 1998, Santa Ana , CA, USA, Soc. Inf. Display, USA cited in the application see the whole document</p> <p>---</p>	1-3,5, 21-23
X	<p>ANONYMOUS: "Liquid Crystal Display" IBM TECHNICAL DISCLOSURE BULLETIN, vol. 41, no. 409138, May 1998, page 647 XP002099562 New York, US see the whole document</p> <p>-----</p>	1

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No

PCT/BY 98/00008

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0854377	A	22-07-1998	JP 10186330 A	14-07-1998
			JP 10186331 A	14-07-1998
			JP 11072793 A	16-03-1999
EP 884626	A	16-12-1998	NONE	
US 5644415	A	01-07-1997	JP 7175037 A	14-07-1995
			JP 7181499 A	21-07-1995

28

PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum)

Box No. I TITLE OF INVENTION

LIQUID-CRISTAL DISPLAY (VARIANTS) AND
THE METHOD OF ITS FABRICATION

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

KONOVALOV, Victor A.
Yakubova str. 6-4-26
220095 Minsk, Belarus

☒ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:



all designated States



all designated States except the United States of America



the United States of America only



the States indicated in the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

MURAVSKY, Anatoly A.
Plekhanova str. 53-88
220085 Minsk, Belarus

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:



all designated States



all designated States except the United States of America



the United States of America only



the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

GORYACHKO, Mariam Sh.
P.O.Box 133, 220012 Minsk, Belarus

Telephone No.

0172840077

Facsimile No.

0172841760

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

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Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☐ AP ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ EA Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ EP European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ OA OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|--|--|
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> GW Guinea-Bissau | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> JP Japan | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> YU Yugoslavia |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |
| <input checked="" type="checkbox"/> LR Liberia | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

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Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

YAKOVENKO, Sergey E.
per. Kaliningradsky 13-95
220012 Minsk, Belarus

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:

- ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

TIMOFEEV, Sergey N.
Kakhovskaya str. 34-9
220068 Minsk, Belarus

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:

- ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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Box No. VI PRIORITY CLAIM		<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.		
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:		
		national application: country	regional application: regional Office	international application: receiving Office
item (1) 6 August 1998 (6.08.1998)	a 19980744	BY		
item (2)				
item (3)				

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY

Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen: the two-letter code may be used):

ISA / EPO

Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):

Date (day/month/year)

Number

Country (or regional Office)

Box No. VIII CHECK LIST: LANGUAGE OF FILING

This international application contains the following number of sheets:

request : 4
description (excluding sequence listing part) : 11
claims : 3
abstract : 2
drawings : 9
sequence listing part of description : _____

Total number of sheets : 29

This international application is accompanied by the item(s) marked below:

1. ☒ fee calculation sheet
2. ☐ separate signed power of attorney
3. ☐ copy of general power of attorney; reference number, if any:
4. ☐ statement explaining lack of signature
5. ☐ priority document(s) identified in Box No. VI as item(s):
6. ☐ translation of international application into (language):
7. ☐ separate indications concerning deposited microorganism or other biological material
8. ☐ nucleotide and/or amino acid sequence listing in computer readable form
9. ☐ other (specify):

Figure of the drawings which should accompany the abstract:

Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT

Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).

KONOVALOV, Victor A.

YAKOVENKO, Sergey E.

MURAVSKY, Anatoly A.

TIMOFEEV, Sergey N.

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

For International Bureau use only
Date of receipt of the record copy by the International Bureau:

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Patent Cooperation Treaty

Request for reduction in the EPO fees for the international search and preliminary examination in favour of nationals of "reform states"

(Decision of the Administrative Council of the European Patent Organisation
of 15 December 1994, OJ EPO 1995, 14)

Addressee ^{a)}

The Belarus Patent Office

66, pr. F. Skoriny
220072 Minsk

BELARUS

a) The addressee is the receiving Office (see notes point 4) or the EPO (see notes point 5)

Applicant's or agent's file reference
(indicated by applicant if desired)

I. Identification of the international application *(must be consistent with PCT request/demand)*

International application No. ^{b)}

PCT/BY98/00008

International filing date ^{b)}

25 September 1998 (25.09.98)

Priority date

06 August 1998
(06.08.98)

b) These boxes are not to be completed if, at the time the request is made, the applicant has not yet been notified of the international filing number or date.

Title of invention

LIQUID-CRISTAL DISPLAY (VARIANTS) AND THE METHOD OF ITS
FABRICATION

II. Request

The applicant(s) identified below (Box IV) herewith request(s) a 75% reduction in the

☒ EPO international search fee

☒ EPO preliminary examination fee

in respect of the above international application, in accordance with the Decision of the Administrative Council of the European Patent Organisation of 15 December 1994.

III. Declaration

(Pre-crossed because conditio sine qua non (see notes point 2). The applicant(s) confirm(s) this declaration by signing Box V; to be checked by receiving Office.

☒ The applicant(s) identified below (Box IV) affirm(s) that the information regarding nationality, residence and/or principal place of business is true. Furthermore the applicant(s) affirm(s) that natural or legal persons who are not nationals of a "reform state" or who have their residence or principal place of business in a state which is not a "reform state" have neither a direct nor an indirect holding or interest.

IV. Applicant *(must be consistent with PCT request/demand)*Further applicants are indicated on supplementary sheet ☒Name and address *(Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)*

KONOVALOV, Victor A.
Yakubova str. 6-4-26
220095 Minsk, Belarus

State *(ie country)* of nationality

BY

State *(ie country)* of residence or principal place of business

BY

Telephone (if any)

Fax (if any)

Telex (if any)

V. Signature of applicant(s) *(Cf. also Notes to Box No. IX of PCT Request Form PCT/RO/101)**(Please type the name of each person signing the request below his signature. The request may be signed by an agent or the common representative (Rules 2.1, 90 PCT).)*

KONOVALOV, Victor A.

YAKOVENKO, Sergey E.

MURAVSKY, Anatoly A.

TIMOFEEV, Sergey N.


Place Minsk

Date 24.09.98

The following boxes are for the use of the receiving Office and European Patent Office respectively

The Belarus Patent Office *(specify)*
acting as receiving Office☒ grants the request for a reduction in the international search fee.☐ does not grant the request for the reasons given on the attached supplementary sheet.☐ A copy of the fee reduction request indicating the above decision has been sent to the EPO branch at The Hague.

Authorised official:

 A. ChenadoDate: 01 October 1998
(01.10.98)The European Patent Office acting as International Preliminary
Examining Authority☐ grants the request for a reduction in the international preliminary examination fee.☐ does not grant the request for the reasons given on the attached supplementary sheet.

Authorised official:

Date:

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

MURAVSKY, Anatoly A.
Plekhanova str. 53-88
220085 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

BY

Telephone (if any)

Fax (if any)

Telex (if any)

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

YAKOVENKO, Sergey E.
per. Kaliningradsky 13-95
220012 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

Telephone (if any)

Fax (if any)

Telex (if any)

BY

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

TIMOFEEV, Sergey N.
Kakhanovskaya str. 34-9
220068 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

BY

Telephone (if any)

Fax (if any)

Telex (if any)

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

State (ie country) of nationality

State (ie country) of residence or principal place of business

Telephone (if any)

Fax (if any)

Telex (if any)

Notes concerning the request for fee reduction (EPO Form 1223/A)

(Please read before completing the form)

Introduction

- 1 The ADMINISTRATIVE COUNCIL of the European Patent Organisation decided on 14 June 1996 to reduce by 75% the EPO fees for the international search and preliminary examination carried out in respect of international applications filed by nationals of certain states. The text of the DECISION is reproduced overleaf.

Who can request the fee reduction

- 2 In order for the fee reduction to be granted, three conditions must be met:
 - 2.1 The decision under 1 is applicable to states which fulfil the requirements for the corresponding reduction in PCT fees payable to the International Bureau of WIPO¹. Relevant information may be found in the PCT Gazette, Section IV, the PCT Applicant's Guide, Annexes D(EP) and E(EP) and the Official Journal of the EPO, or may be obtained from the receiving Office.
 - 2.2 Please note that a fee reduction for the international search may only be granted if the EPO is designated as International Searching Authority (ISA). A fee reduction for the international preliminary examination may only be granted if the EPO is the International Preliminary Examining Authority (IPEA). The latter is the case only where the EPO or the Austrian, Spanish or Swedish Patent Office acted or is acting as ISA.
 - 2.3 If the applicant is a **natural person** he must be a national of **and** must have his residence in a state as indicated under 2.1. The country of nationality and residence must not necessarily be the same.
 - 2.4 If the applicant is a **legal person** such as a company or corporation (private or government-owned), a university or other organisation having legal personality or equivalent status, it must be constituted according to the national law of a state as indicated under 2.1 and have its principal place of business in such a state.
 - 2.5 Natural or legal persons who are **not** nationals of a state as indicated under 2.1, or who have their residence or principal place of business in a state which is not such a state, may have **neither a direct nor an indirect share or interest in the applicant(s)**. For example, companies operating as joint ventures with companies in member countries of the European Union or EFTA, in Australia, Canada, Japan or the USA, or companies having shareholders in such countries, would not be entitled to a fee reduction.
 - 2.6 If there are two or more applicants, **all** of them must meet these conditions at the time of filing the request for fee reduction.

How to request the fee reduction

- 3 The applicant(s) is (are) strongly advised to use the attached request form (EPO Form 1223/A). Although its use is not mandatory, if completed correctly it provides the authority responsible for deciding on the request with all the necessary information.

When to file the request with the competent receiving Office

- 4 The request for a reduction in the EPO fee for international search must be filed with the receiving Office. The request for a reduction in the EPO fee for international preliminary examination should be made simultaneously, even if the applicant has not yet decided whether to file a demand for preliminary examination (but see 5). **Applicants are recommended to submit the request for fee reduction together with the international application.**

When to file the request with the EPO

- 5 Where the applicant(s) at the time of filing the demand for international preliminary examination is (are) not the same as indicated in the international application as filed, or where the request for a reduction in the EPO fee for international preliminary examination has not been made together with that for a reduction in the EPO international search fee, **the request must be filed with the EPO as the competent IPEA. Applicants are recommended to submit the request together with the demand for preliminary examination.**
- 6 Where 4 applies, applicants are strongly recommended to submit a copy of the request for fee reduction filed with the receiving Office together with the demand for preliminary examination.

Precautionary payment of the full amount of fee(s)

- 7 To avoid the risk of loss of rights, applicants are advised to pay in due time the full amount of the EPO international search fee (see Rules 16.1(f), 15.4 PCT) and/or preliminary examination fee (due on filing the demand, see Rule 58.2 PCT). If the request for fee reduction is granted, the receiving Office or the EPO will refund 75% of the fee in question.

¹ (i.e. fees payable to the Receiving Office for the benefit of the International Bureau of WIPO)

PCT

FEE CALCULATION SHEET

Annex to the Request

For receiving Office use only

International application No.

Applicant's or agent's
file reference

Date stamp of the receiving Office

Applicant

KONOVALOV, Victor A.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE 70 USD T

2. SEARCH FEE 312.5 USD S

International search to be carried out by

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains sheets.

first 30 sheets 455 USD b1

remaining sheets x additional amount = b2

Add amounts entered at b1 and b2 and enter total at B 455 USD B

Designation Fees

The international application contains designations.

11 x 105 = 1155 USD D

number of designation fees payable (maximum 11) amount of designation fee

Add amounts entered at B and D and enter total at I 402.5 USD I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) P

5. TOTAL FEES PAYABLE 715 USD

Add amounts entered at T, S, I and P. and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☐ authorization to charge
deposit account (see below)

☐ bank draft

☐ coupons

☐ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO/ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

Deposit Account No.

Date (day/month/year)

Signature

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**ANNEX TO FORM PCT/RO/102
CALCULATION OF THE PRESCRIBED FEES**

International application No.

PCT/BY98/00008

[T] Transmittal Fee

Prescribed amount: 70 USD **[T]**
 Amount paid: 0
 Balance: = 70 USD

☐ correct amount
☐ overpayment
☒ balance due

[S] Search Fee

Prescribed amount: 312.5 USD **[S]**
 Amount paid: 0
 Balance: = 312.5 USD

☐ correct amount
☐ overpayment
☒ balance due

[I] International Fee (*Applicants from certain States are entitled to a reduction of 75% of the international fee; see Notes to the Fee Calculation Sheet as annexed to the Request Form, PCT/RO/101, for details. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D).*)

[B] Basic Fee

Fixed amount for first 30 sheets: 455 USD **[b1]**
 Amount per additional sheet: 10 USD
 Number of additional sheets: x 0 = 0 **[b2]**

Prescribed amount (b1 + b2) = 455 USD **[B]**
 Amount paid: - 0
 Balance: = 455 USD

☐ correct amount
☐ overpayment
☒ balance due

[D] Designation Fee

Amount of designation fee: 105 USD
 Number of designation fees payable (maximum 11): x 11

Prescribed amount = 1,155 USD **[D]**
 Amount paid: - 0
 Balance: = 1,155 USD

☐ correct amount
☐ overpayment
☒ balance due

Add amounts entered at B and D and enter total at I

Prescribed amount: = 402.5 USD **[I]**
 Amount paid: - 0
 Balance: = 402.5 USD

☐ correct amount
☐ overpayment
☒ balance due

[P] Fee for priority document

Prescribed amount: **[P]**
 Amount paid: -
 Balance: =

☐ correct amount
☐ overpayment
☐ balance due

Additional observations (*if necessary*):

- ☐ The amount paid for the designation fee covers the following designations: _____
☐ Other (*specify*): _____

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PCT

REQUEST

The undersigned requests that the present international application be processed according to the Patent Cooperation Treaty.

For receiving Office use only

International Application No.

International Filing Date

Name of receiving Office and "PCT International Application"

Applicant's or agent's file reference
(if desired) (12 characters maximum)

Box No. I TITLE OF INVENTION

LIQUID-CRISTAL DISPLAY (VARIANTS) AND
THE METHOD OF ITS FABRICATION

Box No. II APPLICANT

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

KONOVALOV, Victor A.
Yakubova str. 6-4-26
220095 Minsk, Belarus

☒ This person is also inventor.

Telephone No.

Facsimile No.

Teleprinter No.

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant
for the purposes of:

☒ all designated
States

☐ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental Box

Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

MURAVSKY, Anatoly A.
Plekhanova str. 53-88
220085 Minsk, Belarus

This person is:

☐ applicant only

☒ applicant and inventor

☐ inventor only (If this check-box
is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant
for the purposes of:

☒ all designated
States

☐ all designated States except
the United States of America

☐ the United States
of America only

☐ the States indicated in
the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on a continuation sheet.

Box No. IV AGENT OR COMMON REPRESENTATIVE; OR ADDRESS FOR CORRESPONDENCE

The person identified below is hereby/has been appointed to act on behalf
of the applicant(s) before the competent International Authorities as:

☒ agent

☐ common representative

Name and address: (Family name followed by given name; for a legal entity, full official designation. The address must include postal code and name of country.)

GORYACHKO, Mariam Sh.
P.O.Box 133, 220012 Minsk, Belarus

Telephone No.

01.72840077

Facsimile No.

01.72841760

Teleprinter No.

☐ Address for correspondence: Mark this check-box where no agent or common representative is/has been appointed and the space above is used instead to indicate a special address to which correspondence should be sent.

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Box No.V DESIGNATION OF STATES

The following designations are hereby made under Rule 4.9(a) (mark the applicable check-boxes; at least one must be marked):

Regional Patent

- ☐ **AP** ARIPO Patent: GH Ghana, GM Gambia, KE Kenya, LS Lesotho, MW Malawi, SD Sudan, SZ Swaziland, UG Uganda, ZW Zimbabwe, and any other State which is a Contracting State of the Harare Protocol and of the PCT
- ☒ **EA** Eurasian Patent: AM Armenia, AZ Azerbaijan, BY Belarus, KG Kyrgyzstan, KZ Kazakhstan, MD Republic of Moldova, RU Russian Federation, TJ Tajikistan, TM Turkmenistan, and any other State which is a Contracting State of the Eurasian Patent Convention and of the PCT
- ☒ **EP** European Patent: AT Austria, BE Belgium, CH and LI Switzerland and Liechtenstein, CY Cyprus, DE Germany, DK Denmark, ES Spain, FI Finland, FR France, GB United Kingdom, GR Greece, IE Ireland, IT Italy, LU Luxembourg, MC Monaco, NL Netherlands, PT Portugal, SE Sweden, and any other State which is a Contracting State of the European Patent Convention and of the PCT
- ☐ **OA** OAPI Patent: BF Burkina Faso, BJ Benin, CF Central African Republic, CG Congo, CI Côte d'Ivoire, CM Cameroon, GA Gabon, GN Guinea, ML Mali, MR Mauritania, NE Niger, SN Senegal, TD Chad, TG Togo, and any other State which is a member State of OAPI and a Contracting State of the PCT (if other kind of protection or treatment desired, specify on dotted line)

National Patent (if other kind of protection or treatment desired, specify on dotted line):

- | | |
|---|---|
| <input checked="" type="checkbox"/> AL Albania | <input checked="" type="checkbox"/> LS Lesotho |
| <input checked="" type="checkbox"/> AM Armenia | <input checked="" type="checkbox"/> LT Lithuania |
| <input checked="" type="checkbox"/> AT Austria | <input checked="" type="checkbox"/> LU Luxembourg |
| <input checked="" type="checkbox"/> AU Australia | <input checked="" type="checkbox"/> LV Latvia |
| <input checked="" type="checkbox"/> AZ Azerbaijan | <input checked="" type="checkbox"/> MD Republic of Moldova |
| <input checked="" type="checkbox"/> BA Bosnia and Herzegovina | <input checked="" type="checkbox"/> MG Madagascar |
| <input checked="" type="checkbox"/> BB Barbados | <input checked="" type="checkbox"/> MK The former Yugoslav Republic of Macedonia |
| <input checked="" type="checkbox"/> BG Bulgaria | |
| <input checked="" type="checkbox"/> BR Brazil | <input checked="" type="checkbox"/> MN Mongolia |
| <input checked="" type="checkbox"/> BY Belarus | <input checked="" type="checkbox"/> MW Malawi |
| <input checked="" type="checkbox"/> CA Canada | <input checked="" type="checkbox"/> MX Mexico |
| <input checked="" type="checkbox"/> CH and LI Switzerland and Liechtenstein | <input checked="" type="checkbox"/> NO Norway |
| <input checked="" type="checkbox"/> CN China | <input checked="" type="checkbox"/> NZ New Zealand |
| <input checked="" type="checkbox"/> CU Cuba | <input checked="" type="checkbox"/> PL Poland |
| <input checked="" type="checkbox"/> CZ Czech Republic | <input checked="" type="checkbox"/> PT Portugal |
| <input checked="" type="checkbox"/> DE Germany | <input checked="" type="checkbox"/> RO Romania |
| <input checked="" type="checkbox"/> DK Denmark | <input checked="" type="checkbox"/> RU Russian Federation |
| <input checked="" type="checkbox"/> EE Estonia | <input checked="" type="checkbox"/> SD Sudan |
| <input checked="" type="checkbox"/> ES Spain | <input checked="" type="checkbox"/> SE Sweden |
| <input checked="" type="checkbox"/> FI Finland | <input checked="" type="checkbox"/> SG Singapore |
| <input checked="" type="checkbox"/> GB United Kingdom | <input checked="" type="checkbox"/> SI Slovenia |
| <input checked="" type="checkbox"/> GE Georgia | <input checked="" type="checkbox"/> SK Slovakia |
| <input checked="" type="checkbox"/> GH Ghana | <input checked="" type="checkbox"/> SL Sierra Leone |
| <input checked="" type="checkbox"/> GM Gambia | <input checked="" type="checkbox"/> TJ Tajikistan |
| <input checked="" type="checkbox"/> GW Guinea-Bissau | <input checked="" type="checkbox"/> TM Turkmenistan |
| <input checked="" type="checkbox"/> HR Croatia | <input checked="" type="checkbox"/> TR Turkey |
| <input checked="" type="checkbox"/> HU Hungary | <input checked="" type="checkbox"/> TT Trinidad and Tobago |
| <input checked="" type="checkbox"/> ID Indonesia | <input checked="" type="checkbox"/> UA Ukraine |
| <input checked="" type="checkbox"/> IL Israel | <input checked="" type="checkbox"/> UG Uganda |
| <input checked="" type="checkbox"/> IS Iceland | <input checked="" type="checkbox"/> US United States of America |
| <input checked="" type="checkbox"/> JP Japan | |
| <input checked="" type="checkbox"/> KE Kenya | <input checked="" type="checkbox"/> UZ Uzbekistan |
| <input checked="" type="checkbox"/> KG Kyrgyzstan | <input checked="" type="checkbox"/> VN Viet Nam |
| <input checked="" type="checkbox"/> KP Democratic People's Republic of Korea | <input checked="" type="checkbox"/> YU Yugoslavia |
| | <input checked="" type="checkbox"/> ZW Zimbabwe |
| <input checked="" type="checkbox"/> KR Republic of Korea | |
| <input checked="" type="checkbox"/> KZ Kazakhstan | |
| <input checked="" type="checkbox"/> LC Saint Lucia | |
| <input checked="" type="checkbox"/> LK Sri Lanka | |
| <input checked="" type="checkbox"/> LR Liberia | |

Check-boxes reserved for designating States (for the purposes of a national patent) which have become party to the PCT after issuance of this sheet:

- ☐
- ☐

Precautionary Designation Statement: In addition to the designations made above, the applicant also makes under Rule 4.9(b) all other designations which would be permitted under the PCT except any designation(s) indicated in the Supplemental Box as being excluded from the scope of this statement. The applicant declares that those additional designations are subject to confirmation and that any designation which is not confirmed before the expiration of 15 months from the priority date is to be regarded as withdrawn by the applicant at the expiration of that time limit. (Confirmation of a designation consists of the filing of a notice specifying that designation and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.)

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Continuation of Box No. III FURTHER APPLICANT(S) AND/OR (FURTHER) INVENTOR(S)

If none of the following sub-boxes is used, this sheet should not be included in the request.

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

YAKOVENKO, Sergey E.
per. Kaliningradsky 13-95
220012 Minsk, Belarus

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:

- ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

TIMOFEEV, Sergey N.
Kakhovskaya str. 34-9
220068 Minsk, Belarus

This person is:

- ☐ applicant only
☒ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

BY

State (that is, country) of residence:

BY

This person is applicant for the purposes of:

- ☒ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

Name and address: (Family name followed by given name: for a legal entity, full official designation. The address must include postal code and name of country. The country of the address indicated in this Box is the applicant's State (that is, country) of residence if no State of residence is indicated below.)

This person is:

- ☐ applicant only
☐ applicant and inventor
☐ inventor only (If this check-box is marked, do not fill in below.)

State (that is, country) of nationality:

State (that is, country) of residence:

This person is applicant for the purposes of:

- ☐ all designated States ☐ all designated States except the United States of America ☐ the United States of America only ☐ the States indicated in the Supplemental Box

☐ Further applicants and/or (further) inventors are indicated on another continuation sheet.

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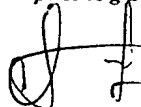


Box No. VI PRIORITY CLAIM					<input type="checkbox"/> Further priority claims are indicated in the Supplemental Box.
Filing date of earlier application (day/month/year)	Number of earlier application	Where earlier application is:			
		national application: country	regional application:* regional Office	international application: receiving Office	
item (1) 6 August 1998 (6.08.1998)	a 19980744	BY			
item (2)					
item (3)					

☐ The receiving Office is requested to prepare and transmit to the International Bureau a certified copy of the earlier application(s) (only if the earlier application was filed with the Office which for the purposes of the present international application is the receiving Office) identified above as item(s):

* Where the earlier application is an ARIPO application, it is mandatory to indicate in the Supplemental Box at least one country party to the Paris Convention for the Protection of Industrial Property for which that earlier application was filed (Rule 4.10(b)(ii)). See Supplemental Box.

Box No. VII INTERNATIONAL SEARCHING AUTHORITY			
Choice of International Searching Authority (ISA) (if two or more International Searching Authorities are competent to carry out the international search, indicate the Authority chosen; the two-letter code may be used):		Request to use results of earlier search; reference to that search (if an earlier search has been carried out by or requested from the International Searching Authority):	
ISA / EPO		Date (day/month/year)	Number Country (or regional Office)

Box No. VIII CHECK LIST; LANGUAGE OF FILING	
This international application contains the following number of sheets: request : 4 description (excluding sequence listing part) : 11 claims : 3 abstract : 2 drawings : 9 sequence listing part of description : Total number of sheets : 29	This international application is accompanied by the item(s) marked below: 1. <input checked="" type="checkbox"/> fee calculation sheet 2. <input type="checkbox"/> separate signed power of attorney 3. <input type="checkbox"/> copy of general power of attorney; reference number, if any: 4. <input type="checkbox"/> statement explaining lack of signature 5. <input type="checkbox"/> priority document(s) identified in Box No. VI as item(s): 6. <input type="checkbox"/> translation of international application into (language): 7. <input type="checkbox"/> separate indications concerning deposited microorganism or other biological material 8. <input type="checkbox"/> nucleotide and/or amino acid sequence listing in computer readable form 9. <input type="checkbox"/> other (specify):
Figure of the drawings which should accompany the abstract:	Language of filing of the international application: English

Box No. IX SIGNATURE OF APPLICANT OR AGENT	
Next to each signature, indicate the name of the person signing and the capacity in which the person signs (if such capacity is not obvious from reading the request).	
 KONOVALOV, Victor A.	 YAKOVENKO, Sergey E.
 MURAVSKY, Anatoly A.	 TIMOFEEV, Sergey N.

For receiving Office use only		2. Drawings: <input type="checkbox"/> received: <input type="checkbox"/> not received:
1. Date of actual receipt of the purported international application:		
3. Corrected date of actual receipt due to later but timely received papers or drawings completing the purported international application:		
4. Date of timely receipt of the required corrections under PCT Article 11(2):		
5. International Searching Authority (if two or more are competent): ISA /	6. <input type="checkbox"/> Transmittal of search copy delayed until search fee is paid.	

Date of receipt of the record copy by the International Bureau:	For International Bureau use only
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Patent Cooperation Treaty

Request for reduction in the EPO fees for the international search and preliminary examination in favour of nationals of "reform states"

(Decision of the Administrative Council of the European Patent Organisation of 15 December 1994, OJ EPO 1995, 14)

Addressee ^{a)}

The Belarus Patent Office

66, pr. F.Skoriny
220072 Minsk

BELARUS

a) The addressee is the receiving Office (see notes point 4) or the EPO (see notes point 5)

Applicant's or agent's file reference
(indicated by applicant if desired)

I. Identification of the international application *(must be consistent with PCT request/demand)*

International application No. ^{b)}

PCT/BY98/00008

International filing date ^{b)}

25 September 1998 (25.09.98)

Priority date

06 August 1998
(06.08.98)

b) These boxes are not to be completed if, at the time the request is made, the applicant has not yet been notified of the international filing number or date.

Title of invention

LIQUID-CRISTAL DISPLAY (VARIANTS) AND THE METHOD OF ITS
FABRICATION

II. Request

The applicant(s) identified below (Box IV) herewith request(s) a 75% reduction in the

☒ EPO international search fee

☒ EPO preliminary examination fee

in respect of the above international application, in accordance with the Decision of the Administrative Council of the European Patent Organisation of 15 December 1994.

III. Declaration

(Pre-crossed because conditio sine qua non (see notes point 2). The applicant(s) confirm(s) this declaration by signing Box V; to be checked by receiving Office.

☒ The applicant(s) identified below (Box IV) affirm(s) that the information regarding nationality, residence and/or principal place of business is true. Furthermore the applicant(s) affirm(s) that natural or legal persons who are not nationals of a "reform state" or who have their residence or principal place of business in a state which is not a "reform state" have neither a direct nor an indirect holding or interest.

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Supplementary sheet to Box IV

Further applicants (must be consistent with PCT request/demand)

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

MURAVSKY, Anatoly A.
Plekhanova str. 53-88
220085 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

BY

Telephone (if any)

Fax (if any)

Telex (if any)

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

YAKOVENKO, Sergey E.
per. Kaliningradsky 13-95
220012 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

Telephone (if any)

Fax (if any)

Telex (if any)

BY

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

TIMOFEEV, Sergey N.
Kakhanovskaya str. 34-9
220068 Minsk, Belarus

State (ie country) of nationality

BY

State (ie country) of residence or principal place of business

BY

Telephone (if any)

Fax (if any)

Telex (if any)

Name and address (Surname followed by first name; for a legal entity, full official designation. The address must include post code and name of country.)

State (ie country) of nationality

State (ie country) of residence or principal place of business

Telephone (if any)

Fax (if any)

Telex (if any)

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PCT

FEE CALCULATION SHEET Annex to the Request

For receiving Office use only

International application No.

Date stamp of the receiving Office

Applicant's or agent's
file reference

Applicant

KONOVALOV, Victor A.

CALCULATION OF PRESCRIBED FEES

1. TRANSMITTAL FEE 70 USD T

2. SEARCH FEE 312.5 USD S

International search to be carried out by

(If two or more International Searching Authorities are competent in relation to the international application, indicate the name of the Authority which is chosen to carry out the international search.)

3. INTERNATIONAL FEE

Basic Fee

The international application contains _____ sheets.

first 30 sheets 455 USD b1

_____ x _____ = _____ b2
remaining sheets additional amount

Add amounts entered at b1 and b2 and enter total at B 455 USD B

Designation Fees

The international application contains _____ designations.

11 x 105 = 1155 USD D

number of designation fees payable (maximum 11) amount of designation fee

Add amounts entered at B and D and enter total at I 402.5 USD I

(Applicants from certain States are entitled to a reduction of 75% of the international fee. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D.)

4. FEE FOR PRIORITY DOCUMENT (if applicable) P

5. TOTAL FEES PAYABLE 715 USD

Add amounts entered at T, S, I and P, and enter total in the TOTAL box

TOTAL

☐ The designation fees are not paid at this time.

MODE OF PAYMENT

☐ authorization to charge
deposit account (see below)

☐ bank draft

☐ coupons

☐ cheque

☐ cash

☐ other (specify):

☐ postal money order

☐ revenue stamps

DEPOSIT ACCOUNT AUTHORIZATION (this mode of payment may not be available at all receiving Offices)

The RO/ _____ ☐ is hereby authorized to charge the total fees indicated above to my deposit account.

☐ is hereby authorized to charge any deficiency or credit any overpayment in the total fees indicated above to my deposit account.

☐ is hereby authorized to charge the fee for preparation and transmittal of the priority document to the International Bureau of WIPO to my deposit account.

Deposit Account No.

Date (day/month/year)

Signature

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**ANNEX TO FORM PCT/RO/102
CALCULATION OF THE PRESCRIBED FEES**

International application No.

PCT/BY98/00008

[T] Transmittal Fee

Prescribed amount: 70 USD **[T]**
 Amount paid: 0
 Balance: = 70 USD

☐ correct amount
☐ overpayment
☒ balance due

[S] Search Fee

Prescribed amount: 312.5 USD **[S]**
 Amount paid: 0
 Balance: = 312.5 USD

☐ correct amount
☐ overpayment
☒ balance due

[I] International Fee *(Applicants from certain States are entitled to a reduction of 75% of the international fee; see Notes to the Fee Calculation Sheet as annexed to the Request Form, PCT/RO/101, for details. Where the applicant is (or all applicants are) so entitled, the total to be entered at I is 25% of the sum of the amounts entered at B and D).*

[B] Basic Fee

Fixed amount for first 30 sheets: 455 USD **[b1]**
 Amount per additional sheet: 10 USD
 Number of additional sheets: x 0 = 0 **[b2]**

Prescribed amount (b1 + b2) = 455 USD **[B]**
 Amount paid: - 0
 Balance: = 455 USD

☐ correct amount
☐ overpayment
☒ balance due

[D] Designation Fee

Amount of designation fee: 105 USD
 Number of designation fees payable (maximum 11): x 11

Prescribed amount = 1,155 USD **[D]**
 Amount paid: - 0
 Balance: = 1,155 USD

☐ correct amount
☐ overpayment
☒ balance due

Add amounts entered at B and D and enter total at I

Prescribed amount: = 402.5 USD **[I]**
 Amount paid: - 0
 Balance: = 402.5 USD

☐ correct amount
☐ overpayment
☒ balance due

[P] Fee for priority document

Prescribed amount: **[P]**
 Amount paid: -
 Balance: =

☐ correct amount
☐ overpayment
☐ balance due

Additional observations (if necessary):

- ☐ The amount paid for the designation fee covers the following designations: _____
☐ Other (specify): _____

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PATENT COOPERATION TREAT

PCT

NOTIFICATION CONCERNING
SUBMISSION OR TRANSMITTAL
OF PRIORITY DOCUMENT

(PCT Administrative Instructions, Section 411)

From the INTERNATIONAL BUREAU

To:

GORYACHKO, Mariam Sh.
P.O. Box 133
Minsk 220012
BÉLARUS

Date of mailing (day/month/year) 19 January 1999 (19.01.99)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference	
International application No. PCT/BY98/00008	International filing date (day/month/year) 25 September 1998 (25.09.98)
International publication date (day/month/year) Not yet published	Priority date (day/month/year) 06 August 1998 (06.08.98)
Applicant KONOVALOV, Victor, A. et al	

- The applicant is hereby notified of the date of receipt (except where the letters "NR" appear in the right-hand column) by the International Bureau of the priority document(s) relating to the earlier application(s) indicated below. Unless otherwise indicated by an asterisk appearing next to a date of receipt, or by the letters "NR", in the right-hand column, the priority document concerned was submitted or transmitted to the International Bureau in compliance with Rule 17.1(a) or (b).
- This updates and replaces any previously issued notification concerning submission or transmittal of priority documents.
- An asterisk(*) appearing next to a date of receipt, in the right-hand column, denotes a priority document submitted or transmitted to the International Bureau but not in compliance with Rule 17.1(a) or (b). In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.
- The letters "NR" appearing in the right-hand column denote a priority document which was not received by the International Bureau or which the applicant did not request the receiving Office to prepare and transmit to the International Bureau, as provided by Rule 17.1(a) or (b), respectively. In such a case, the attention of the applicant is directed to Rule 17.1(c) which provides that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity, upon entry into the national phase, to furnish the priority document within a time limit which is reasonable under the circumstances.

<u>Priority date</u>	<u>Priority application No.</u>	<u>Country or regional Office or PCT receiving Office</u>	<u>Date of receipt of priority document</u>
06 Augu 1998 (06.08.98)	19980744	BY	04 Janu 1999 (04.01.99)

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland Facsimile No. (41-22) 740.14.35	Authorized officer Carlos Naranjo Telephone No. (41-22) 338.83.38
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PATENT COOPERATION TREATY

PCT

NOTIFICATION OF RECEIPT OF
RECORD COPY

(PCT Rule 24.2(a))

From the INTERNATIONAL BUREAU

To:

GORYACHKO, Mariam Sh.
P.O. Box 133
Minsk 220012
BÉLARUS

Date of mailing (day/month/year) 19 October 1998 (19.10.98)	IMPORTANT NOTIFICATION
Applicant's or agent's file reference	International application No. PCT/BY98/00008

The applicant is hereby notified that the International Bureau has received the record copy of the international application as detailed below.

Name(s) of the applicant(s) and State(s) for which they are applicants:

KONOVALOV, Victor, A. et al (all designated States)

International filing date : 25 September 1998 (25.09.98)

Priority date(s) claimed : 06 August 1998 (06.08.98)

Date of receipt of the record copy
by the International Bureau : 15 October 1998 (15.10.98)

List of designated Offices :

EA : AM, AZ, BY, KG, KZ, MD, RU, TJ, TM

EP : AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE

OA : BF, BJ, CF, CG, CI, CM, GA, GN, GW, ML, MR, NE, SN, TD, TG

National : AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, CA, CH, CN, CU, CZ, DE, DK, EE, ES, FI, GB, GE, GH, GM, HR, HU, ID, IL, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MD, MG, MK, MN, MW, MX, NO, NZ, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TR, TT, UA, UG, US, UZ, VN, YU, ZW

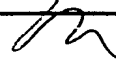
ATTENTION

The applicant should carefully check the data appearing in this Notification. In case of any discrepancy between these data and the indications in the international application, the applicant should immediately inform the International Bureau.

In addition, the applicant's attention is drawn to the information contained in the Annex, relating to:

- ☒ time limits for entry into the national phase
- ☒ confirmation of precautionary designations
- ☒ requirements regarding priority documents

A copy of this Notification is being sent to the receiving Office and to the International Searching Authority.

The International Bureau of WIPO 34, chemin des Colombettes 1211 Geneva 20, Switzerland	Authorized officer:  Beatriz Morariu
Facsimile No. (41-22) 740.14.35	Telephone No. (41-22) 338.83.38

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INFORMATION ON TIME LIMITS FOR ENTERING THE NATIONAL PHASE

The applicant is reminded that the "national phase" must be entered before each of the designated Offices indicated in the Notification of Receipt of Record Copy (Form PCT/IB/301) by paying national fees and furnishing translations, as prescribed by the applicable national laws.

The time limit for performing these procedural acts is **20 MONTHS** from the priority date or, for those designated States which the applicant elects in a demand for international preliminary examination or in a later election, **30 MONTHS** from the priority date, provided that the election is made before the expiration of 19 months from the priority date. Some designated (or elected) Offices have fixed time limits which expire even later than 20 or 30 months from the priority date. In other Offices an extension of time or grace period, in some cases upon payment of an additional fee, is available.

In addition to these procedural acts, the applicant may also have to comply with other special requirements applicable in certain Offices. It is the applicant's responsibility to ensure that the necessary steps to enter the national phase are taken in a timely fashion. Most designated Offices do not issue reminders to applicants in connection with the entry into the national phase.

For detailed information about the procedural acts to be performed to enter the national phase before each designated Office, the applicable time limits and possible extensions of time or grace periods, and any other requirements, see the relevant Chapters of Volume II of the PCT Applicant's Guide. Information about the requirements for filing a demand for international preliminary examination is set out in Chapter IX of Volume I of the PCT Applicant's Guide.

GR and ES became bound by PCT Chapter II on 7 September 1996 and 6 September 1997, respectively, and may, therefore, be elected in a demand or a later election filed on or after 7 September 1996 and 6 September 1997, respectively, regardless of the filing date of the international application. (See second paragraph above.)

Note that only an applicant who is a national or resident of a PCT Contracting State which is bound by Chapter II has the right to file a demand for international preliminary examination.

CONFIRMATION OF PRECAUTIONARY DESIGNATIONS

This notification lists only specific designations made under Rule 4.9(a) in the request. It is important to check that these designations are correct. Errors in designations can be corrected where precautionary designations have been made under Rule 4.9(b). The applicant is hereby reminded that any precautionary designations may be confirmed according to Rule 4.9(c) before the expiration of 15 months from the priority date. If it is not confirmed, it will automatically be regarded as withdrawn by the applicant. There will be no reminder and no invitation. Confirmation of a designation consists of the filing of a notice specifying the designated State concerned (with an indication of the kind of protection or treatment desired) and the payment of the designation and confirmation fees. Confirmation must reach the receiving Office within the 15-month time limit.

REQUIREMENTS REGARDING PRIORITY DOCUMENTS

For applicants who have not yet complied with the requirements regarding priority documents, the following is recalled.

Where the priority of an earlier national, regional or international application is claimed, the applicant must submit a copy of the said earlier application, certified by the authority with which it was filed ("the priority document") to the receiving Office (which will transmit it to the International Bureau) or directly to the International Bureau, before the expiration of 16 months from the priority date, provided that any such priority document may still be submitted to the International Bureau before that date of international publication of the international application, in which case that document will be considered to have been received by the International Bureau on the last day of the 16-month time limit (Rule 17.1(a)).

Where the priority document is issued by the receiving Office, the applicant may, instead of submitting the priority document, request the receiving Office to prepare and transmit the priority document to the International Bureau. Such request must be made before the expiration of the 16-month time limit and may be subjected by the receiving Office to the payment of a fee (Rule 17.1(b)).

If the priority document concerned is not submitted to the International Bureau or if the request to the receiving Office to prepare and transmit the priority document has not been made (and the corresponding fee, if any, paid) within the applicable time limit indicated under the preceding paragraphs, any designated State may disregard the priority claim, provided that no designated Office may disregard the priority claim concerned before giving the applicant an opportunity to furnish the priority document within a time limit which is reasonable under the circumstances.

Where several priorities are claimed, the priority date to be considered for the purposes of computing the 16-month time limit is the filing date of the earliest application whose priority is claimed.

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PATENT COOPERATION TREATY

From the RECEIVING OFFICE

PCT

NOTIFICATION OF THE INTERNATIONAL APPLICATION NUMBER AND OF THE INTERNATIONAL FILING DATE

(PCT Rule 20.5(c))

To:

GORYACHKO, Mariam Sh.

P.O.Box 133,
220012 Minsk

BELARUS

Date of mailing 02 October 1998
(day/month/year) (02.10.98)

Applicant's or agent's file reference

IMPORTANT NOTIFICATION

International application No.

PCT/BY98/00008

International filing date (day/month/year)

25 September 1998(25.09.98)

Priority date (day/month/year)

06 August 1998(06.08.98)

Applicant

KONOVALOV V.A. et al.

Title of the invention

LIQUID-CRYSTAL DISPLAY (VARIANTS) AND THE METHOD
OF ITS FABRICATION

1. The applicant is hereby notified that the international application has been accorded the international application number and the international filing date indicated above.

2. The applicant is further notified that the record copy of the international application:

☒ was transmitted to the International Bureau on 02 October 1998(02.10.98)

☐ has not yet been transmitted to the International Bureau for the reason indicated below and a copy of this notification has been sent to the International Bureau*:

☐ because the necessary national security clearance has not yet been obtained.

☐ because (reason to be specified):

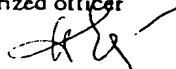
- * The International Bureau monitors the transmittal of the record copy by the receiving Office and will notify the applicant (with Form PCT/IB/301) of its receipt. Should the record copy not have been received by the expiration of 14 months from the priority date, the International Bureau will notify the applicant (Rule 22.1(c)).

Name and mailing address of the receiving Office

НАЦІОНАЛЬНИ КОМІТЕТ
Патентного управління

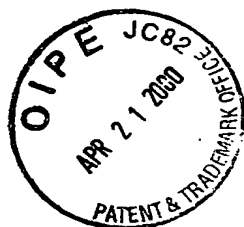
Facsimile No. Minsk, np. G. Chapiuski, 65

Authorized officer



A. Chenado

Telephone No. 84 06 68



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